Gestation period in some Indian Bats

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Data regarding the pregnancy record of several species of Indian bats collected through many years are presented along with relevant notes about the season of pregnancy and the body weights of the adults and of the new-born young. Ecological and physiological factors are discussed in relation to gestation in bats. It is concluded that the length of gestation is basically genetically determined. The duration and the season of pregnancy are so adjusted that the young are delivered during the time of the year when environmental conditions are at optimum.

INTRODUCTION

Over the past 20 years extensive investigations have been carried out in this laboratory on the breeding habits and various aspects of reproductive physiology of several Indian species of bats. During these investigations complete and accurate records of the gestation periods in several species of bats have been carefully maintained. Since there is no systematic and comprehensive record of the gestation periods of Indian bats, it was felt that a report on the subject with notes on the pregnancy seasons in these species would be of considerable interest and value to future investigators on this subject, and to workers interested in the ecology and the natural history of these bats.

There seems to be an approximate direct relationship between the size of the body of the eutherian mammal and the duration of pregnancy in it, and usually the larger the mammal the longer is the period of gestation. However, this correlation between the size of the body and the length of gestation is modified by various factors such as the size of the litter, the occurrence of hibernation, prolonged pregnancy due to delayed implantation of the blastocyst and so on. Generally, among eutherian mammals of approximately the same adult size the monotocous species have a longer gestation than the polytocous ones, and in the latter the larger the litter size the shorter the duration of pregnancy. If hibernation overlaps the breeding season, the gestation period is prolonged either due to delayed implantation of the blastocyst or due to the slowing down of the rate of development of the foetus. The size of the new-born young has also some relationship to the size of the litter and the duration of pregnancy.

The study of gestation in bats is of considerable interest because of the extraordinary morphological and physiological adaptations seen in these animals, and because of the great range of variations in size, reproductive habits and food among the different species. The adults of the fruit-bats of India and Australia (*Pteropus*) weigh nearly 900 gm., while some of the insectivorous bats weigh just 4·5 gm. (Baker & Bird 1936). Bats are cosmopolitan in distribution, and exhibit various reproductive adaptations to suit the ecological conditions of their habitats. Further, they have an abnormal inverted resting posture due to which the gestation sac in the bats rests on the diaphragm instead of on the pelvis or on the ventral abdominal wall as in other mammals. The relatively large size of the new-born young in the bats has resulted in the adaptation of the pelvic ligament of the mother in such a way that the pelvic symphysis becomes greatly stretched during parturition to allow the passage of the large young. Also, the wing and the interfemoral membrane together become converted into a receptacle to receive the young at delivery in many species. Whereas the food of a given species of bat is quite specific, it varies among the different species of bats. Thus, some are exclusively frugivorous, some insectivorous, some sanguivorous, some carnivorous and a few nectorivorous. These differences in the food habits have some bearing on the reproductive activities of the bats, because these animals have to choose the most propitious period in the year for delivering the young so that the mother in lactation, as well as the young one after weaning,may be assured of sufficient food supply. Thus, the extreme morphological and physiological specializations seen in these animals, and the ecological conditions in which they live have considerably influenced the reproductive habits of the bats. The season of copulation, the duration of pregnancy, and the number and size of the young in each litter are closely related to these factors.

Observations and discussion

In Table 1 are presented data relating to certain aspects of the breeding habits of some of the Indian bats, which have been studied in this laboratory. Against each species the period of the year, when pregnant specimens are present, is mentioned under the column 'Pregnancy season'. All the species mentioned in the table have a strict breeding season in the year. In most species the 'Pregnancy season' is longer than the gestation period of the individual specimen because all the female specimens of a species, and within a colony, do not copulate on the same day. Consequently all deliveries do not occur on the same day within a colony. But all the adult females copulate within a short period in the breeding season, and all deliveries take place within a short period. The gestation period for each species has been calculated as follows :—The date on

which fertilization was first noticed (or calculated from the age of the earliest developmental stage seen) was noted. Similarly the date, on which the first delivery occurred in the colony, was also noted. The number of days between these two dates was calculated. In the same manner, the number of days was calculated between the last date (in the copulation season), when fertilization was noticed, to the last date, when delivery occurred in the colony. The average of the two calculated number of days is taken as the correct gestation period for the species. Since the pregnancy record is maintained for several successive years the gestation period has been verified year after year. In none of the species studied is there anything comparable to delayed implantation, because, in all the species, fertilization is immediately followed by pregnancy. Also, none of the species studied experiences hibernation so that the possibility of slowing down of development does not occur.

The gestation period is known with reasonable certainty in only a few species of bats. Table 2 gives the data pertaining to the gestation period of bats other than those mentioned in Table 1.

The examination of the two tables (Tables 1 and 2) reveal certain interesting features. The large fruit-bats *Pteropus giganteus* and *Pteropus geddiei* (Baker & Baker 1936) weighing from 600 to 900 gm. have about the same gestation period as *Hipposideros ater* weighing only 5 to 7 gm. Secondly, *Hipposideros fulvus fulvus*, and *Pipistrellus ceylonicus chrysothrix* have almost the same body weight, but the gestation period varies in them, being 155 to 160 days in the former and 50 to 55 days in the latter. In all these cases the new born young is relatively large in size and weighs between 15% to 25% of the adult body weight. These comparisons indicate that, among bats, the duration of pregnancy is not directly related to the size of the adult or to the size of the new born young. The litter size also does not have any bearing on the length of gestation, because, both among the monotocous species as well as among the polytocous ones, there are marked variations in the duration of pregnancy. Food and ecological conditions also do not seem to influence gestation directly as evidenced by the fact that *Hipposideros fulvus fulvus* and *Pipistrellus ceylonicus chrysothrix* live in the same localities and under the same conditions, they have the same size of the body and their food habits are the same, but their gestation periods are very different.

From the foregoing it is evident that the factors governing the gestation period in bats are far more intricate than those mentioned earlier for the eutherian mammals in general. An extremely interesting observation has been made by Pearson *et al.* (1952) in the American bat, *Corynorhinus rafinesquei*. In this species the gestation period varied in different colonies and during the different years when they made their observations. The range was from 56 days to 100 days. Pearson *et al.* (1952) stated, ' Such variability in the length of gestation is most unusual

TABLE 1

GESTATION PERIOD AND OTHER RELEVANT DATA ABOUT SOME INDIAN BATS

Species	Locality	Wt. of adult in gm.	Wt. of young in gm.	No. of young in the litter	Gestation period in days	Pregnancy season
Cynopterus sphinx gangeticus	Nagpur	80-100	12-14	1	115-125	October to July (2 litters)
Rousettus leschenaulti	Aurangabad	50-90	12	1	125	November to July (2 litters)
Pteropus giganteus giganteus	Nagpur	600-900	—	1	140-150	November to April
Megaderma lyra lyra	Nagpur and Aurangabad	40-45	7-8	1	150-160	November to May
Hipposideros fulvus fulvus	Nanded	8-9	2·2	1	155-160	November to May
Hipposideros ater	Nanded	5-7	1-1·2	1	155-160	December to June
Hipposideros bicolor pallidus	Pilani	5-7	1·2	1	40-45	March to May
Pipistrellus ceylonicus chrysothrix	Nanded	7-8	1·2-1·4	2-3	50-55	July to September
Scotophilus wroughtoni	Bangalore	—	—	2	105-115	March to July

TABLE 2

DATA COLLECTED FROM LITERATURE ON THE GESTATION PERIODS IN BATS

Species	Body weight in gm.	Length of gestation	Authority
Pteropus geddiei	450 to 875	5 to 6 months	Baker & Baker ('36)
Rhinopoma kinneari	30 to 35	123 days	Anand Kumar ('65)
Desmodus rotundus murinus	38 to 48·5	Over 5 months	Wimsatt & Trapido ('52)
Myotis lucifugus lucifugus	—	50 to 60 days	Wimsatt ('45)
Pipistrellus pipistrellus	—	44 days	Deanesly & Warwick ('39)
Pipistrellus tralatitius abramus	—	About 70 days	Uchida ('50)
Corynorhinus rafinesquei	7·72 to 8.35	56 to 100 days	Pearson *et al* ('52)
Miniopterus australis	4·5 to 7·9	About 110 days	Baker & Bird ('36)
Tadarida cynocephala	—	77 to 84 days	Sherman ('37)

among mammals and may be associated with varying amounts of torpidity in different years with varying climatic conditions'. They further suggest that the differences in the duration of gestation may be due to variation in the rates of development in the pre-implantation stage because ' development of the embryo is probably more uniform after implantation, when almost all females have a warm body temperature, than in early pregnancy when some females have low body temperatures and others high'. This suggestion implies that delayed implantation of the blastocyst occurs in *Corynorhinus rafinesquei* if the females are in a torpid hibernating condition after fertilization of the ovum, and that the embryo implants immediately after fertilization, if the female maintains normal metabolic level and body temperature. Another bat experiencing delayed implantation is *Eidolon helvum* (Mutere 1965), which, surprisingly, is a tropical fruit-bat from equatorial Africa.

While working on *Desmodus rotundus*, Wimsatt & Trapido (1952) observed, ' Data assembled from the literature suggest that among bats some direct correlation exists between the length of gestation and the size of the animals. It also reveals a tendency for the gestation period to be longer in tropical than in temperate zone species'. However, the data presented in the present paper indicate that the gestation period in bats does not have any relationship to the size of the adult or the size and number of the young delivered, or the geographical location or other ecological factors. Perhaps, the duration of pregnancy in a given species is primarily genetically determined, and only slight variations in gestation length may occur in specific cases due to climatic and physiological factors. It appears that the essential aim is to deliver the young in the most favourable season, and different species of bats have devised different means to accomplish this. The unfavourable seasons like severe winter or very hot summer or the season of incessant rain are avoided for parturition.

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